

Pharmaceuticals In the Environment: Risks and sustainable challenges

Background: Close to a hundred different pharmaceuticals and residuals have been identified in surface waters, groundwater, and tap water at low levels, in Europe, the US and also in Canada. Pharmaceuticals have also been detected in sludge, manure, treated soil, and in agricultural run-off. These facts raise legitimate questions and concerns in the public and thus prompt decision-makers to require assessments of the hazards and risks associated in response. Presence of pharmaceuticals in the surface waters and in soils poses questions about agricultural practices. Are there risks? Direct human health adverse risks have been suggested not to be significant. Environmental risks however, are not clear. The issue of pharmaceuticals in the environment also raises a sequence of serious questions regarding both risk assessment and risk management, some of these we will address. One of the key issues is the potential paradox between environmental and human health - and the interconnectedness of the two over time. Another is assessing the potential effects of low-level exposure of complex mixtures of medicinal products where acute effects are not likely, but where chronic, additive or synergistic modes of action might significantly affect metabolism, behaviour, and reproduction of non-target organisms. Finally, the issue of antimicrobial resistance due to prescription of antibiotics to humans and as growth promoters in livestock holds significant potential risks. Presently, we only see the tip of the iceberg. From a risk assessment, management, and stakeholder perspective the current situation is that environmental monitoring of fate and effects of the more than 12 000 pharmaceuticals and personal care products (PPCPs) is limited to only a fraction ($< 1-2\%$) of these biologically potentially very active compounds. So what? Where do we start looking, for which compounds, and which effects, and which potential regulations – in a scientific and cost-effective way and - without unnecessary delay of drug development?

Aim: This symposium will address the above questions as a starting point to pool our scientific resources addressing risk assessment and management questions in dialogue with the invitees. The seminar will be structured around four core themes with a Canadian focus:

- 1) Exposure and fate assessment
- 2) Assessment of effects on multiple trophic levels
- 3) Antimicrobial effects and resistance
- 4) International updates and prioritization tool developments

There will be an opportunity for invitees to give presentations of 3 slides (5 minutes) or presentation of mini-posters summarizing your current challenges and research needs under each theme, and which will be of great value in a coordinated and collaborative research approach. Moreover, plenty of time during breaks and in the afternoon will be reserved for discussion. Over lunch we will organize a tour of our aquatic experimental model ecosystem facility next to the seminar venue, where currently two pharmaceutical mixture studies are in progress. All presentations and abstracts from the seminar will be collected in a booklet for the invitees.

SEMINAR PROGRAM JULY 21ST IN GUELPH (hsander@uoguelph.ca)

9.00 Welcome: Hans Sanderson (UoG)

9.10 Update on international developments regarding pharmaceuticals in the environment: Keith Solomon (UoG).

9.30 Sewage treatment plants as sources to pharmaceuticals in Ontario surface waters: Chris Metcalfe (TU).

9.50 An exposure assessment of antibiotics used in livestock production within a model watershed in Southern Ontario. Linda Lissemore (UoG)

10.10 Coffey

10.40 Persistence and degradation pathways of pharmaceuticals: Monica Lam, (UT)

11.00 Detection and assessment of antibiotic's mobility and transformation in agricultural soils: Jules Carlson (UT)

11.20 Release of pharmaceuticals to groundwater: Carol Ptacek (CCIW+UW)

11.40 External presenters (3 slides – 5 min) + Discussion

12.00 Lunch + microcosm tour

13.30 Prioritization and ranking of pharmaceuticals based on QSAR toxicity assessment: Hans Sanderson (UoG).

13.50 Assessment of community and population responses of freshwater invertebrates to pharmaceutical mixtures: Christian Wilson (UoG).

14.10 Effects of pharmaceutical mixtures on higher plants under semi-field and laboratory conditions: Richard Brain (UoG).

14.30 Development of freshwater fish species sensitivity distributions to pharmaceuticals: David Johnson (UoG).

14.50 Coffey

15.30 Assessing the effects of select pharmaceuticals on the functional and structural diversity of freshwater sediment bacterial communities: Amanda Warne (UoG)

15.50 Impacts and persistence of antibiotics on soil environmental microbial communities: Ed Topp (Agri.-Canada)

16.10 Influence of animal use of antibiotics on the environment and on human health: Scott McEwen (UoG)

16.30-17.30 External presenters (3 slides – 5 min) + Discussion

For further information, contact:

Hans Sanderson, Research Associate, Ph.D,
University of Guelph, Centre for Toxicology,
Bovey Bldg., Guelph, ON, N1G 2W1, Canada.
Tel. +1-519-824-4120 ext. 54794.
Fax. +1-519-837-3861.
Email. hsander@uoguelph.ca